



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Fumiyoishi Ono

Group art Unit: 1765

Serial No.: 09/313,356

Examiner: C. Brown

Filed: May 18, 1999

For: COMPOSITION FOR POLISHING METAL ON SEMICONDUCTOR WAFER
AND METHOD OF USING SAME

DECLARATION UNDER 37 C.F.R. §1.132

Honorable Commissioner of Patents and Trademarks,
Washington, D.C. 20231

Sir:

I, Hajime Sato, a citizen of Japan, residing at c/o
Showa Denko K.K. Shiojiri Plant, 1, Oaza Soga, Shiojiri-shi,
Nagano 399-6461, Japan, hereby declare the following.

1. I graduated from Hokkaido University, Faculty of Medicine in 1979 and obtained a degree of Ph. Dr from the same university for medicine in 1984. My doctoral thesis was entitled "Periodical Control Mechanism of Cell Form Change in Relation with Shrinkable Protein".

I entered Showa Denko K.K. in 1984. Since then I have been engaged in the research and development in the

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application of FCM (Flow Cytometry, clinical inspection apparatus) from 1984 to 1987; production of bioproducts including enzymes, natural colorants, vitamins and medical components from 1987 to 1996; biological agricultural chemicals from 1992 to 1996; clinical diagnosis system from 1996 to 1999; and abrasives from 1999 to the present.

2. In the Advisory Action, the Examiner asserts that Kasai discloses an alumina particle with an alpha phase content of 80 - 90% which reads on the applicant's limitation of having an alpha conversion rate of 65 - 90%. The Examiner is also of the opinion that since Streinz discloses alumina particles having a surface area of 30 m²/g to 100 m²/g, the present invention concerning alumina particles having an alpha conversion rate of 65 - 90% and a surface area of 30 - 80 m²/g is easily reached by a person skilled in the art.

However, as the Examiner acknowledges, Kasai fails to teach or suggest alumina particles having a surface area of 30 - 80 m²/g and Streinz fails to teach or suggest alumina particles having an alpha conversion rate of 65 - 90%.

Further, the present invention resides in finding the criticality of using alumina particles having a surface area of 30 - 80 m²/g and an alpha conversion rate of 65 - 90% in a polishing composition for polishing a metal film on a

semiconductor substrate. This is described in the specification of the present application, particularly in the section of SUMMARY OF THE INVENTION.

The following comparative examples were conducted to show the criticality more clearly.

3. Additional Comparative Examples 2 to 5:

(Comparative Example 2)

The procedures of Example 1 of the present specification were repeated but the slurry was prepared by pulverization only in an apex mill for 2 hours and a slurry, WA-400 produced by Cabot Corporation (specific surface area of the solid content contained in the slurry: 50 m²/g, crystal structure: intermediate alumina: grain size d50: 0.15 µm), was mixed at a weight ratio of 9:1.

(Comparative Example 3)

The procedures of Example 1 were repeated but the slurry was prepared by pulverization only in an apex mill for 8 hours and a slurry, WA-400 produced by Cabot Corporation, was mixed at a weight ratio of 7:3.

(Comparative Example 4)

The slurries of Comparative Examples 2 and 3 were mixed at a weight ratio of 8:3 to form a slurry of this Comparative Example.

(Comparative Example 5)

The procedures of Example 1 were repeated but the slurry was prepared by pulverization only in an apex mill for 32 hours.

(Evaluation)

The evaluation was made using the same method as in Example 1. The results are shown in the following Table in which the results of Examples 1 to 9 and Comparative Example 1 of the present specification are also included.

(Results)

It is seen in the Table that as the surface area of the alumina becomes less than 30 m^2/g , the number of scratches rapidly increases; as the surfaced area of the alumina becomes more than 80 m^2/g , the polishing rate of the metal significantly decreases and when the alpha conversion rate is less than 65% or more than 90%, the selection ratio decreases.

It is therefore clearly shown that use of alumina particles having an alpha conversion rate of 65 - 90% and a surface area of 30 - 80 m^2/g in a polishing composition for polishing a metal film on a semiconductor substrate has a criticality.

Table

Example No., Comparative Example No.	Properties of Alumina-Type Fine Particle			Polishing Accelerator			Kind of Metal Polished	Polishing Rate (Å/min)	Selection Ratio	Evaluation of Scratch
	Conversion Ratio (%)	α	Specific Surface Area (m ² /g)	Kind	Concentration at the Evaluation of Polishing	Metal	Thermal Oxide Film			
Example 1	87	62	iron nitrate enneahydrate	3.5 wt%	tungsten	4800	8	600	2	
Example 2	90	31	iron nitrate enneahydrate	3.5 wt%	tungsten	5400	12	450	3	
Example 3	68	63	iron nitrate enneahydrate	3.5 wt%	tungsten	3900	7	560	1	
Example 4	68	77	iron nitrate enneahydrate	3.5 wt%	tungsten	4400	9	490	2	
Example 5	87	62	ammonium cerium (IV) nitrate	5.0 wt%	tungsten	5000	20	250	3	
Example 6	87	62	ammonium cerium (IV) sulfate	5.0 wt%	tungsten	2800	15	190	2	
Example 7	87	62	cerium (IV) sulfate	5.0 wt%	tungsten	2600	6	430	2	
5 Example 8	87	62	iron nitrate enneahydrate	3.5 wt%	aluminum	6000	8	750	3	
	87	62	iron nitrate enneahydrate	3.5 wt%	copper	7500	8	940	2	
Comparative Example 1	38 or less	50	iron nitrate enneahydrate	3.5 wt%	tungsten	4000	45	90	5	
Comparative Example 2	85	27	iron nitrate enneahydrate	3.5 wt%	tungsten	5600	11	510	5	
Comparative Example 3	62	59	iron nitrate enneahydrate	3.5 wt%	tungsten	3800	32	120	1	
Comparative Example 4	93	32	iron nitrate enneahydrate	3.5 wt%	tungsten	5300	30	180	4	
Comparative Example 5	72	85	iron nitrate enneahydrate	3.5 wt%	tungsten	2800	19	150	2	

I, the undersigned declarant, declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and; further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001, of Title 18, of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signed this 27 th day of June , 2001

Hajime Sato

Hajime Sato